

Application News

Measuring Low Flow Rates On Aerospace Test Stands

Industry: Aerospace **Service:** Flow Rate

Fluid: MIL-PRF-23699 Synthetic Turbine Oil
(Mobil Jet II & Exxon 2380)

Overview

Aircraft component manufacturers and OEMs require state-of-the-art flow instrumentation for use in engine and component test environments. Turbine flow meters have long been the choice for aerospace industry testing. They are very accurate, have a wide turndown ratio, and, when using Universal Viscosity Calibration (UVC) techniques, can be employed over a wide viscosity (temperature) range. However, turbine meters have limitations at the lowest extended flow rates, particularly when applying viscosity-compensating techniques.

Situation

Honeywell Aerospace, a diversified technology and manufacturing leader of aerospace products and services, required a test stand to measure Mobil Jet II and Exxon 2380 synthetic turbine oils (MIL-PRF-23699) from 0.03 to 5 Gallons-Per-Minute (GPM) over a temperature range of 55° to 65° F. The viscosity variation over the specified temperature range was from 63 to 86 cSt.

Honeywell decided to employ a standard turbine flow meter, paired with a viscosity-compensating transmitter, for test stand flow rates above 0.3 GPM. However, lower flow rates, down to 0.03 GPM, were well below the realm of viscosity compensating techniques. Although low-flow turbine meters can measure down to 0.001 GPM, their use is limited to viscosities well below those for this application. In addition, these meters are very viscosity sensitive, and viscosity compensation techniques will not apply. Another technology had to be used for extremely low flow rates.

Solution

Flow Technology's diverse flow measuring product line provided a solution for this demanding test stand application. Whereas turbine flow meters alone could not handle the combined flow and viscosity ranges, the addition of a TrickleMeter® positive displacement (PD) meter covered all the required flow rate and temperature specifications.

The TrickleMeter is ideal for measuring very low flows of medium to high viscosity liquids. Its positive displacement design, with only two moving parts, provides rugged, reliable operation for a variety of applications. The meter withstands pressures up to 1,000 PSI and provides up to 100:1 turndown.

System Description

Flow Technology supplied its standard FT6-8AEU2-LEA-1 turbine flow meter along with an LNT-3-C0-V1B6 Linear Link® TCI (Temperature Compensating Interface) for flow rates from 0.3 to 5 GPM. The turbine meter was calibrated in 25 and 90 cSt oils, providing UVC data for all viscosities from 50° to 100° F (for future application considerations). An FTFS6-8AE10-5-T flow straightener set was configured with a tap provision for a 3/16" temperature probe, and a 100-Ohm platinum RTD assembly was provided for a temperature input.

The Linear Link TCI transmitter was programmed with the turbine's UVC curve, as well as a temperature versus viscosity table for MIL-PRF-23699 turbine oil. The system provides accurate flow data from 0.3 to 5 GPM over the full temperature and flow ranges.

For the lower flow rates (below 0.3 GPM), the test stand utilized an L001-6C9T12-10300 TrickleMeter PD meter. A LN-5-B-V1B6 Linear Link was selected to provide the desired output signal. The PD meter was calibrated at the threshold viscosity of 40 centipoises, providing accurate flow measurement down to 0.01 GPM for the specified temperature range. Should oil temperatures rise above the specified maximum of 65° F up to 100° F, the effect on calibration would be negligible for flow rates above 0.10 GPM-increasing to no more than 0.75% of reading additional error at the lowest specified flow rate of 0.03 GPM.

Technical Information

Flowmeters: FT6-8AEU2-LEA-1 turbine flowmeter and LNT-3-C0-V1B6 viscosity-compensating transmitter

Flow Rate: 0.3 to 5 GPM

Fluid: MIL-PRF-23699 synthetic turbine oil (Mobil Jet II & Exxon 2380)

Flowmeters: L001-6C9T12-10300 TrickleMeter PD flow meter, SRP-221-QD pickoff and LN-5-B-V1B6 linearizing transmitter

Flow Rate: 0.03 to 0.3 GPM

Fluid: MIL-PRF-23699 synthetic turbine oil (Mobil Jet II & Exxon 2380)



8930 S. Beck Ave., Suite 107 • Tempe, AZ, 85284 USA
Tel: 480.240.3400 • Fax: 480.240.3401 • Toll-free: 800.528.4225
E-mail: fmarket@ftimeters.com • Web: www.ftimeters.com
©2007 Flow Technology, Inc. DB-68600 Rev. A